II. AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Original) Apparatus for measuring water of hydration in a polyelectrolyte membrane (PEM) comprising:

a source of input radiation directed at an input location on the PEM; and

a detector responsively positioned at an output location relative to the input location for determining a sensible change in the input radiation indicative of a level of water hydration in the PEM.

2. (Original) Apparatus according to claim 1, wherein the radiation is at least one of infrared, near infrared, visible, and ultraviolet.

3. (Currently Amended) Apparatus according to claim 1, wherein the sensible change is a change in at least one of absorption, fluorescence, and refractive index.

4. (Original) Apparatus according to claim 1, including means for carrying the input radiation to the input location; and means for carrying the sensibly changed input radiation to the detector.

5. (Original) Apparatus according to claim 4, wherein the means for carrying input radiation and the output radiation comprises an optical waveguide.

6. (Original) Apparatus according to claim 1, further comprising a window in the PEM for optically connecting the input and output locations.

7. (Original) Apparatus according to claim 6, wherein the window comprises a portion of the PEM formed without electrode overcoating.

8. (Original) Apparatus according to claim 1, wherein the PEM includes a fluorophore operative to produce fluorescence in response to the input radiation.

9. (Original) Apparatus according to claim 8, wherein the water of hydration present in the PEM selectively quenches the fluorescence in accordance with the concentration thereof in the PEM.

10. (Original) Apparatus according to claim 1, wherein the PEM is in a fuel cell and further including means for determining the temperature of the fuel cell as a function of water of hydration present in the PEM.

11. (Original) Apparatus according to claim 1, further including processor means for producing a control output in response to the output signal.

12. (Original) Apparatus according to claim 1, wherein the PEM includes a material selected from the group comprising a perfluorinated polymer.

13. (Currently Amended) Apparatus according to claim 1, wherein the PEM includes a dye selected from the group comprising functionalized perylenes, ~~and~~ binaphthyls,; and dihydroxybipyridyles.

14. (Original) Apparatus according to claim 1 wherein the PEM has opposite surfaces and includes an electrode material disposed on each of the opposite surfaces, and wherein the input location comprises an aperture formed in the electrode material.

15. (Original) Apparatus according to claim 1 wherein the PEM has opposite surfaces and includes an electrode material disposed on each of the opposite surfaces, and wherein the output location comprises an aperture formed in the electrode material.

16. (Original) Apparatus according to claim 1, wherein the PEM has opposite surfaces and includes an electrode material disposed on the opposite surfaces, and wherein the input and output locations comprise at least one of an aperture formed in respective ones of the contact layers wherein input light is launched and output light is received.

17. (Original) Apparatus according to claim 16 wherein the input and output windows are optically aligned on opposite sides of the PEM.

18. (Original) Apparatus according to claim 1, where in the PEM has opposite surfaces and includes an electrode material on each of the opposite surfaces, and wherein the input and output locations comprise at least one aperture formed in a selected one of the contact layers, wherein input light is launched and output light is received through the aperture in the selected one of the contact layers.

19. (Original) Apparatus according to claim 16 wherein the input and output windows are disposed on the same side of the PEM.

20. (Original) Apparatus according to claim 1, wherein a reflector is disposed on a surface of the PEM opposite the aperture for reflecting input light towards the aperture.

21. (Original) A method for measuring hydration of a polyelectrolyte membrane (PEM) formed of a selected material comprising the steps of:

forming an input location in the PEM;

launching a source of radiation into the input location for reaction with the PEM material;

detecting the reaction of the input radiation with the PEM material; and

determining a sensible change in the input radiation as a result of the reaction indicative of a level of water hydration in the PEM.

22. (Original) The method of claim 21, wherein the radiation comprises energy including at least one of infrared, near infrared, visible, and ultraviolet.

23. (Currently Amended) The method of claim 21, wherein the sensible change is a change in at least one of absorption, and fluorescence of the input radiation.

24. (Original) The method of claim 21, wherein the PEM has an electrically conductive coating on opposite surfaces thereof and forming an input location comprises forming a window in at least one electrode on the PEM.